START

0035609

APR 01 1994
Sta 21 120

ENGINEERING DATA TRANSMITTAL

1. EDT 601420

2. To: (Receiving Organization)	3. From: (Originating Organization)	4. Related EDT No.:
Environmental Engineering	Environmental Restoration Project Safety Engineering	N/A
5. Proj./Prog./Dept./Div.:	**6. Cog. Engr.:**	**7. Purchase Order No.:**
N/A	J. A. Locklair	N/A
8. Originator Remarks: This document is being transmitted for review and release.		**9. Equip./Component No.:** N/A
		10. System/Bldg./Facility: 107 Retention Basins
11. Receiver Remarks:		**12. Major Assm. Dwg. No.:** N/A
		13. Permit/Permit Application No.: N/A
		14. Required Response Date: March 15, 1994

APR 1994 RECEIVED EPIC

9413275.0035

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Impact Level	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	WHC-SD-EN-SAD-027		0	Safety Assessment for the Decontamination and Dismantlement of th 107-C, 107-KE, 107-KW, and 107-F Retention Basins	2 ESQ	1&2	1	

16. KEY

Impact Level (F)	Reason for Transmittal (G)	Disposition (H) & (I)
1, 2, 3, or 4 (see MRP 5.43)	1. Approval 4. Review 2. Release 5. Post-Review 3. Information 6. Dist. (Receipt Acknow. Required)	1. Approved 4. Reviewed no/comment 2. Approved w/comment 5. Reviewed w/comment 3. Disapproved w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION (See Impact Level for required signatures)

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.
1	1	Cog.Eng. D.L. Smith		3/17/94	T7-05	ERPSE N.R. Kerr		3/14/94	H4-67	1	1
1	1	Cog. Mgr. M.A. Mihal			X5-55	OTESE J.J. Zimmer		3/22/94	H4-67	1	1
1	1	QA J.C. Plastino		3/22/94	X0-20						
1	1	Safety L.C. Haslam			X0-51						
1	1	Env. K. A. Gano		3/22/94	X0-21						
1	1	ER Health Physics K. M. Smith			H4-06						
1	1	M.A. Tredway		3/17/94	R3-54						

18.	19.	20.	21. DOE APPROVAL (if required) Ltr. No.
J.A. Locklair 3-16-94 Signature of EDT Originator / Date	3/22/94 Authorized Representative for Receiving Organization / Date	3.16.94 Cognizant/Project Engineer's Manager / Date	[ ] Approved [ ] Approved w/comments [ ] Disapproved w/comments

BD-7400-172-2 (07/91) GEF097

BD-7400-172-1 (07/91)

THIS PAGE INTENTIONALLY
LEFT BLANK

Date Received: 4/1/94

INFORMATION RELEASE REQUEST

Reference: WHC-CM-3-4

Complete for all Types of Release

Purpose

- [ ] Speech or Presentation (Check only one suffix)
  - [ ] Full Paper
  - [ ] Summary
  - [ ] Abstract
  - [ ] Visual Aid
- [ ] Speakers Bureau
- [ ] Poster Session
- [ ] Videotape
- [ ] Reference
- [x] Technical Report
- [ ] Thesis or Dissertation
- [ ] Manual
- [ ] Brochure/Flier
- [ ] Software/Database
- [ ] Controlled Document
- [ ] Other

ID Number (include revision, volume, etc.)
WHC-SD-EN-SAD-027, REV. 0

List attachments.
Appendices A, B, C, and D

Date Release Required
March 14, 1994

Title: Safety Assessment for the Decontamination and Dismantlement of the 107-C, 107-KE, 107-KW, and 107-F Retention Basins

Unclassified Category: UC-

Impact Level: 2 ESQ

New or novel (patentable) subject matter? [X] No [ ] Yes
If "Yes", has disclosure been submitted by WHC or other company?
[ ] No [ ] Yes Disclosure No(s).

Information received from others in confidence, such as proprietary data, trade secrets, and/or inventions?
[X] No [ ] Yes (Identify)

Copyrights? [ ] No [ ] Yes
If "Yes", has written permission been granted?
[ ] No [ ] Yes (Attach Permission)

Trademarks?
[ ] No [X] Yes (Identify) Map Spectrum Analyzer is a tradename of Scitec Corporation.

Complete for Speech or Presentation

Title of Conference or Meeting

Group or Society Sponsoring

Date(s) of Conference or Meeting

City/State

Will proceedings be published? [ ] Yes [ ] No
Will material be handed out? [ ] Yes [ ] No

Title of Journal

CHECKLIST FOR SIGNATORIES

Review Required per WHC-CM-3-4	Yes	No	Reviewer - Signature Indicates Approval: Name (printed) / Signature / Date
Classification/Unclassified Controlled Nuclear Information	[ ]	[x]	
Patent - General Counsel	[ ]	[x]	OGC Memo 2/4/93 - H. Marquez 3/30/94
Legal - General Counsel	[ ]	[x]	OGC Memo 2/4/93 - H. Marquez 3/30/94
Applied Technology/Export Controlled Information or International Program	[ ]	[x]	
WHC Program/Project	[ ]	[x]	
Communications	[ ]	[x]	
RL Program/Project	[x]	[ ]	Jeff Bruggeman 3/25/94
Publication Services	[x]	[ ]	Di Byron No edit 4/1/94
Other Program/Project	[ ]	[x]	

Information conforms to all applicable requirements. The above information is certified to be correct.

	Yes	No
References Available to Intended Audience	[x]	[ ]
Transmit to DOE-HQ/Office of Scientific and Technical Information	[ ]	[x]

Author/Requestor (Printed/Signature) / Date
J. A. Locklair J A Locklair 3-16-94

Intended Audience
[ ] Internal [ ] Sponsor [X] External

Responsible Manager (Printed/Signature) / Date
N. R. Kerr NRK 3-16-94

INFORMATION RELEASE ADMINISTRATION APPROVAL STAMP

Stamp is required before release. Release is contingent upon resolution of mandatory comments.

APPROVED FOR RELEASE OFFICIAL USE ONLY DOCUMENT Date 4/1/94

Date Cancelled

Date Disapproved

9402275.0036

THIS PAGE INTENTIONALLY
LEFT BLANK

SUPPORTING DOCUMENT

1. Total Pages 57

2. Title

Safety Assessment for the Decontamination and Dismantlement of the 107-C, 107-KE, 107-KW, and 107-F Retention Basins

3. Number

WHC-SD-EN-SAD-027

4. Rev No.

0

5. Key Words

retention basins
radioactive nuclides and chemicals
safety assessment
hazardous material inventory

APPROVED FOR PUBLIC RELEASE V. Burkland 4/1/94

6. Author

Name: J.A. Locklair

Signature

Organization/Charge Code 29550/E25016

7. Abstract

This document provides a safety assessment of potential hazards associated with the decontamination and dismantlement of the 107-C, 107-KE, 107-KW, and 107-F retention basins. The basins are located in the 100 Areas of the Hanford Site, along the Columbia River

8. PURPOSE AND USE OF DOCUMENT - This document was prepared for use within the U.S. Department of Energy and its contractors. It is to be used only to perform, direct, or integrate work under U.S. Department of Energy contracts. This document is not approved for public release until reviewed.

PATENT STATUS - This document copy, since it is transmitted in advance of patent clearance, is made available in confidence solely for use in performance of work under contracts with the U.S. Department of Energy. This document is not to be published nor its contents otherwise disseminated or used for purposes other than specified above before patent approval for such release or use has been secured, upon request, from the Patent Counsel, U.S. Department of Energy Field Office, Richland, WA.

DISCLAIMER - This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or any third party's use or the results of such use of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

9. Impact Level 2 ESQ

10. RELEASE STAMP

OFFICIAL RELEASE BY WHC
DATE APR 01 1994
Sta. 21

THIS PAGE INTENTIONALLY
LEFT BLANK

CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF TERMS

DAC	derived air concentration
DCG	derived concentration guide
dpm	disintegrations per minute
msl	mean sea level
OSHA	Occupational Safety and Health Administration
OSL	operational safety limits
WHC	Westinghouse Hanford Company

This page intentionally left blank.

SAFETY ASSESSMENT FOR THE DECONTAMINATION AND DISMANTLEMENT OF THE 107-C,107-KE,107-KW, AND 107-F RETENTION BASINS

1.0 INTRODUCTION AND PURPOSE

This document provides a safety assessment of potential hazards associated with the decontamination and dismantlement of the 107-C, 107-KE, 107-KW, and 107-F retention basins. The basins are located in the 100 Areas of the Hanford Site, along the Columbia River (Figure 1-1). The basins are constructed of reinforced concrete and steel and store approximately 38 million L (10 million gal) of cooling water discharged from the Hanford Site reactors during operation. Large volumes of water, contaminated with radioactive nuclides and chemicals, were stored in the basins before discharge to the Columbia River or cribs. Discharge of this water stopped when the reactors shut down. The metal structures have since deteriorated and the migration of contaminants has been detected.

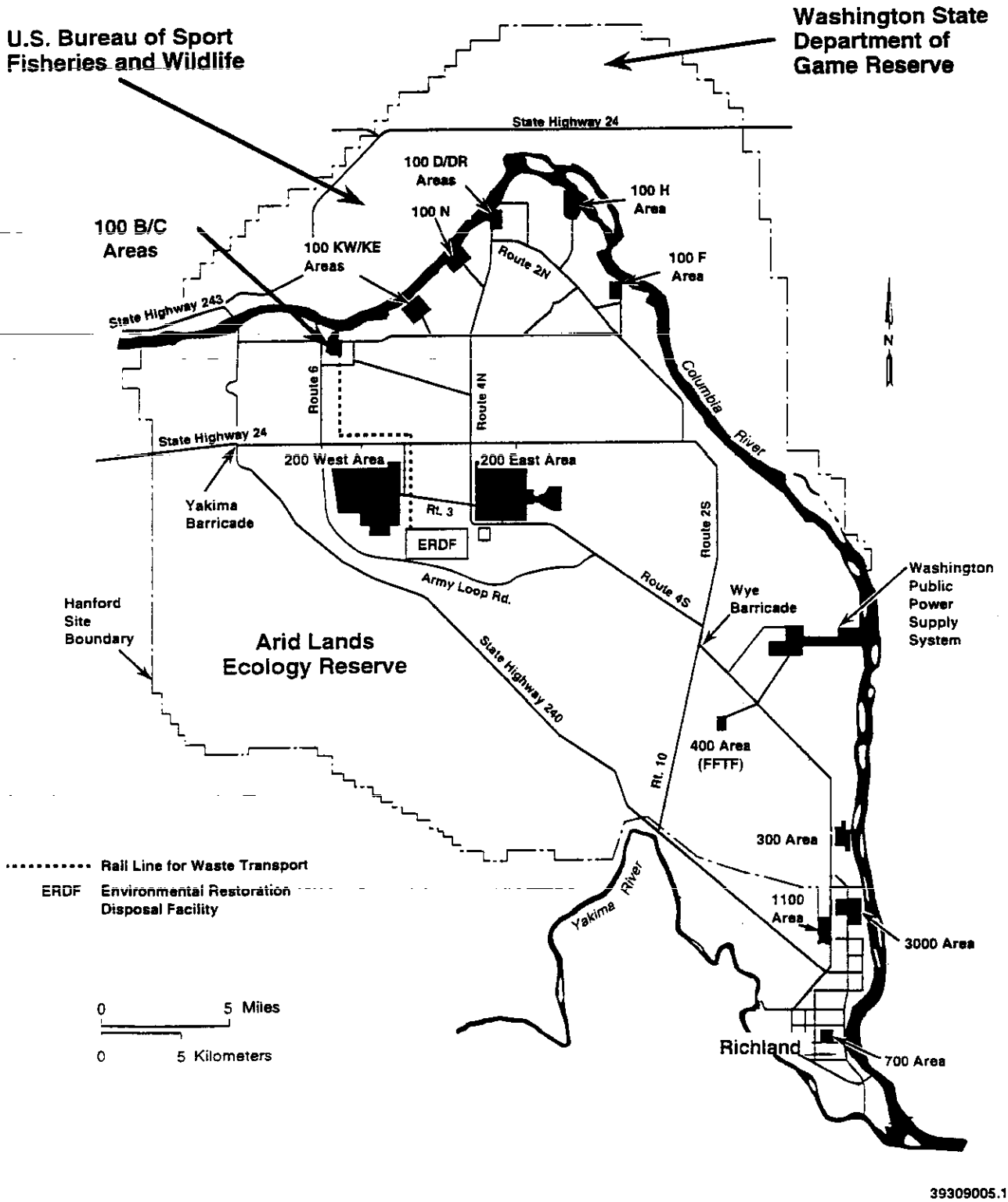
The 107-C has two basins, each containing 38 million L (10 million gal); and the 107-KE and 107-KW have six basins altogether, each containing 35 million L (9 million gal) (Dorian and Richards 1978; Smith 1993). Each retention basin has approximately a 0.64 cm (0.25 in.) of radiologically and chemically contaminated sludge covered with approximately 0.91 to 1.83 m (3 to 6 ft) of clean overburden (Dorian and Richards 1978; Smith 1993). The interior walls are contaminated with radionuclides, but heavy metal or chemical contaminants have not been detected. The exterior walls are painted with a lead-based paint that has flaked off in many areas, exposing bare metal. The 107-F basin activity will involve only the piping, as the basin is constructed of concrete and is belowgrade.

The purpose of the proposed activities is to (1) decontaminate basin interior walls and piping, (2) section and remove abovegrade structures, and (3) dispose of decontaminated scrap metal to salvage. Decontaminated scrap metal above acceptable release criteria in DOE Order 5480.11 (DOE 1988) will be sent to onsite burial.

After the abovegrade basin structures are removed, the basin sites will be maintained to reduce potential contaminant migration until final closure decisions are made. There are no plans to disturb the sludge, remove the basin foundation, or remove contaminated subsoils.

Principal radioactive contaminants are ^{137}Cs, ^{60}Co, ^{154}Eu, ^{155}Eu, and small amounts of other radionuclides. Nuclide concentrations detected by characterization studies (Dorian and Richards 1978) at the 107-C retention basin are provided in Section 4.1. The hazards are based on the radioactive constituent ^{60}Co loose or attached on the interior basin walls and piping (^{60}Co is more restrictive and has similar characteristics gamma emitters).

Figure 1-1. Hanford Site Map.



Chemical contaminants will consist of the lead content contained in the paint covered on the exterior walls of the retention basins. This lead content should not be a hazard concern, but if lead-paint removal is required during the decontamination and dismantlement activities, the emission controls and Operational Safety Limits (OSL) in Section 6.0 shall be observed. Therefore, the imposed radiological limit (in paragraph 1.1 of OSL-1) will bound both radiological and chemical inventories of concern. The OSLs are provided to assure activities for the basins will be conducted within the bounds of this assessment.

Limits for annual dose equivalency in Table 2.1 of WHC-CM-1-6, *Westinghouse Hanford Company Radiological Control Manual*, and in Appendix A shall be used during the proposed basin activities. Historical data (Dorian and Richards 1978; Smith 1993) indicate the levels in WHC-CM-1-6 will not be approached. However, it is prudent to apply the current criteria in WHC-CM-1-6 for radiological controls. The potential risks, and chemical and radiological concerns have been evaluated against the limits and guidelines in WHC-CM-4-46, *Nonreactor Facility Safety Analysis Manual* for the following receptor groups: (1) the facility worker, (2) the Hanford Site worker not involved in basin activities, and (3) the public.

The decontamination and dismantlement of the basins are below-low hazard activities because of the very low radionuclide inventories (DOE 1992b). Consequently, the activities have been classified as radiological. Based on hazard classification criteria, the review and approval requirements will be commensurate with the radiological hazard classification.

This safety assessment meets the requirements in DOE Order 5480.23, (DOE 1992a) and implements the criteria in DOE 1992b.

This page intentionally left blank.

2.0 WORK DESCRIPTION

The decontamination and dismantlement activities for the 107-C, 107-KE, 107-KW retention basin walls, and the 107-F piping will remove the contaminant source and reduce the possibility for migration of radioactive contaminants to the Hanford Site. The intent of these activities is to control and prevent migration of contaminants in accordance with existing guidelines and directives.

2.1 PROCESS

The interior basin walls will be decontaminated by a wet abrasive blasting that will minimize the spread of contaminants and maximize productivity of the decontamination process. The process employs a grit media forced by air through a nozzle, impacting the surface with enough kinetic energy to dislodge the contaminant. To minimize dispersal of contaminants into the air, water is used in the nozzle, making the grit wet. The wet grit is intended to reduce airborne contamination and keep the airborne risk as low as reasonably achievable.

After decontamination, the steel walls will be cut into manageable sections and removed. Walls will be cut with industry-standard acetylene torches and, in some areas, with hydraulic sheers. Verification that existing contaminants have been removed shall be documented in accordance with the criteria in Appendix A before the walls are released for disposal offsite. Movement of heavy wall sections will be in accordance with institutional controls in 29 CFR 1910 and WHC-CM-4-40, *Industrial Hygiene Manual*, WHC-CM-4-3, *Industrial Safety Manual*, DOE-RL 1993a, and WHC-CM-1-6 to ensure human safety and manage industrial hazards. When walls have been removed, contaminated grit waste will be stabilized and remain in situ, pending resolution of final basin site-closure requirements or consistent with the Record of Decision. Interim stabilization of the activity site for each basin will employ 30.5 to 61 cm (12 to 24 in.) of uncontaminated soil cover. Figure 2-1 illustrates a flow diagram for basin activities.

2.1 LOCATION AND DESCRIPTION

The Hanford Site is located in south-central Washington State, approximately 273 km (170 mi) southeast of Seattle and 201 km (125 mi) southwest of Spokane (Figure 1-1). The Hanford Site occupies an area of approximately 1,450 km^2 (560 mi^2) within the semiarid Pasco Basin of the Columbia Plateau. The topography is relatively flat although elevations range from greater than 1,000 m (3,300 ft) above mean sea level (msl) at Rattlesnake Mountain to 107 m (350 ft) above msl along the Columbia River. The 107-C, 107-KE, 107-KW, and 107-F Areas are situated along the Columbia River in the northern portion of the Hanford Site with an elevation of 119 m to 143 m (390 ft to 470 ft). The gradient increases slightly away from the river channel. Figures 2-2 and 2-3 illustrate the location of the 107-C retention basin and Figures 2-4 and 2-5 illustrate the location of the 107 KE and 107 KW retention basins.

Figure 2-1. Flow Diagram for Work Activities.

107-C Retention Basin		
Stage 1	Stage 2	Stage 3
Backfill as needed ↓ Remove overburden to weld	Decontaminate interior walls ↓ Decontaminate exterior walls as needed	Section and remove walls ↓ Survey for release/disposal

107-KE/KW Retention Basin		
Stage 1	Stage 2	Stage 3
Backfill as needed ↓ Remove overburden to weld	Decontaminate interior walls ↓ Decontaminate exterior walls as needed ↓ Section and decontaminate piping	Section and remove walls ↓ Survey for release/disposal

107-F Retention Basin	
Stage 1	Stage 2
Section and remove piping	Decontaminate as necessary ↓ Survey for release/disposal

Figure 2-2. 107-C Retention Basin.

Figure 2-3. Location of 107-C Basin

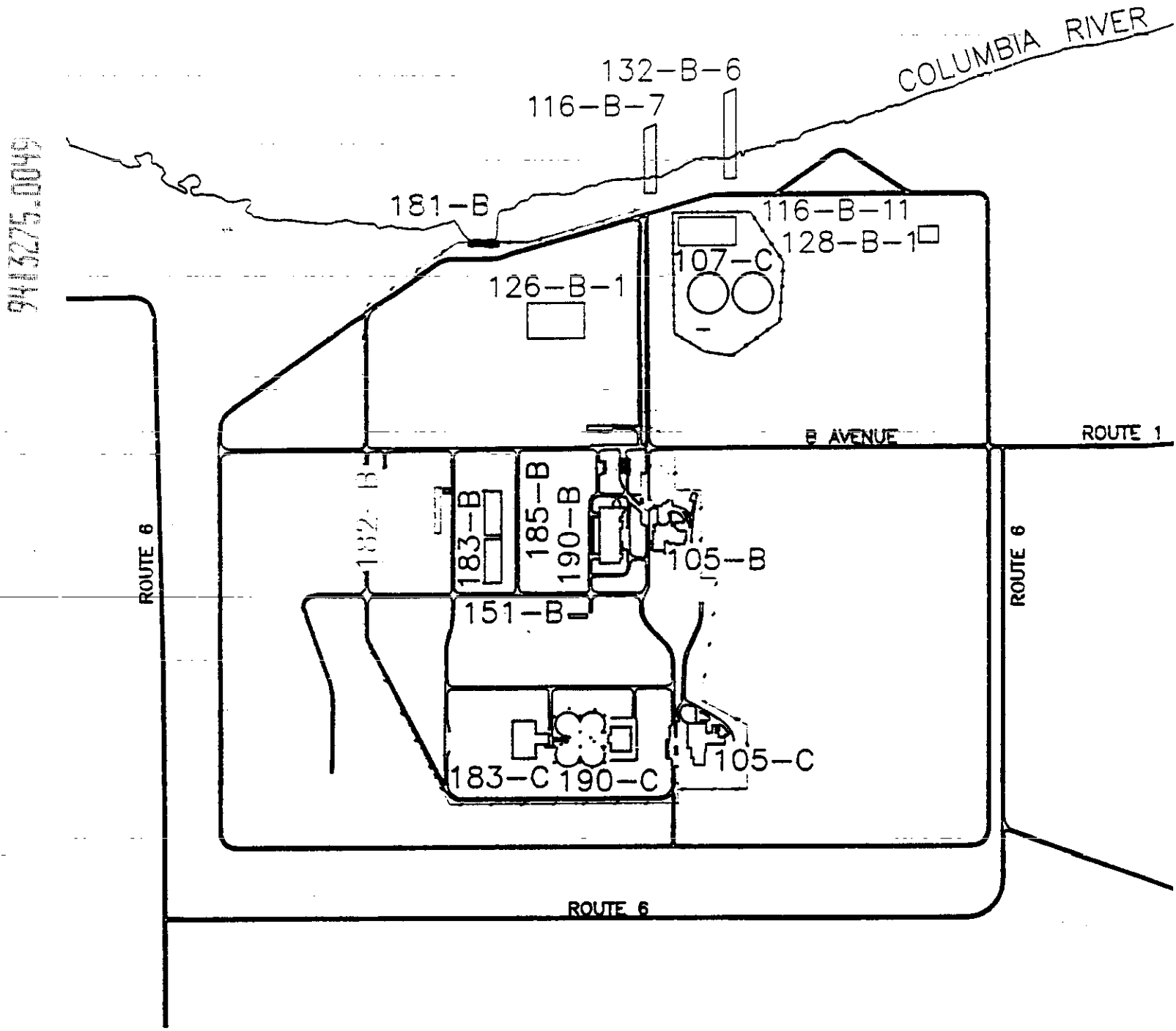
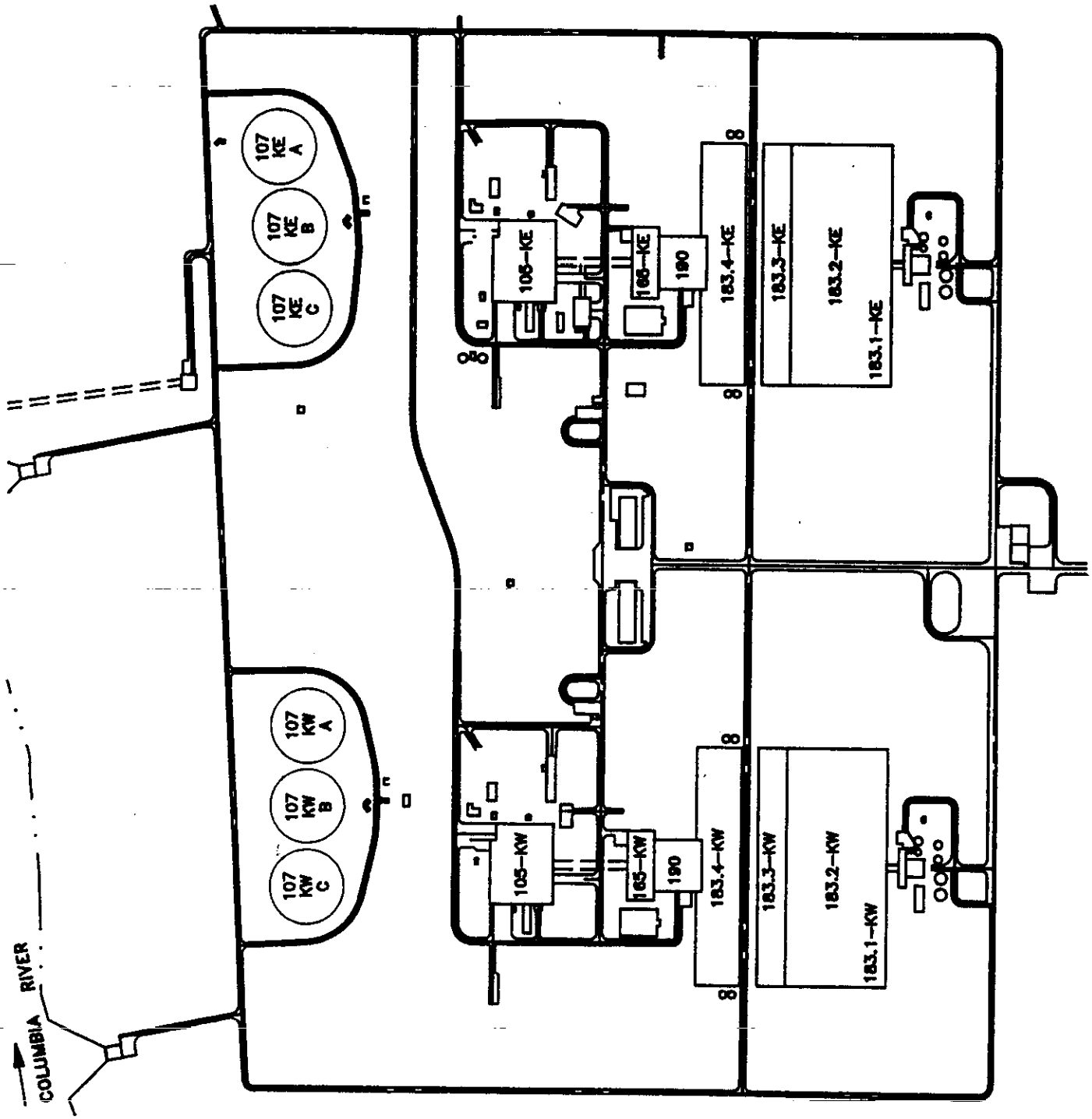


Figure 2-4. 107-KE and 107-KW Retention Basins.

Figure 2-5. Location of 107-KE and 107-KW Retention Basins.



3.0 HANFORD SITE DESCRIPTION

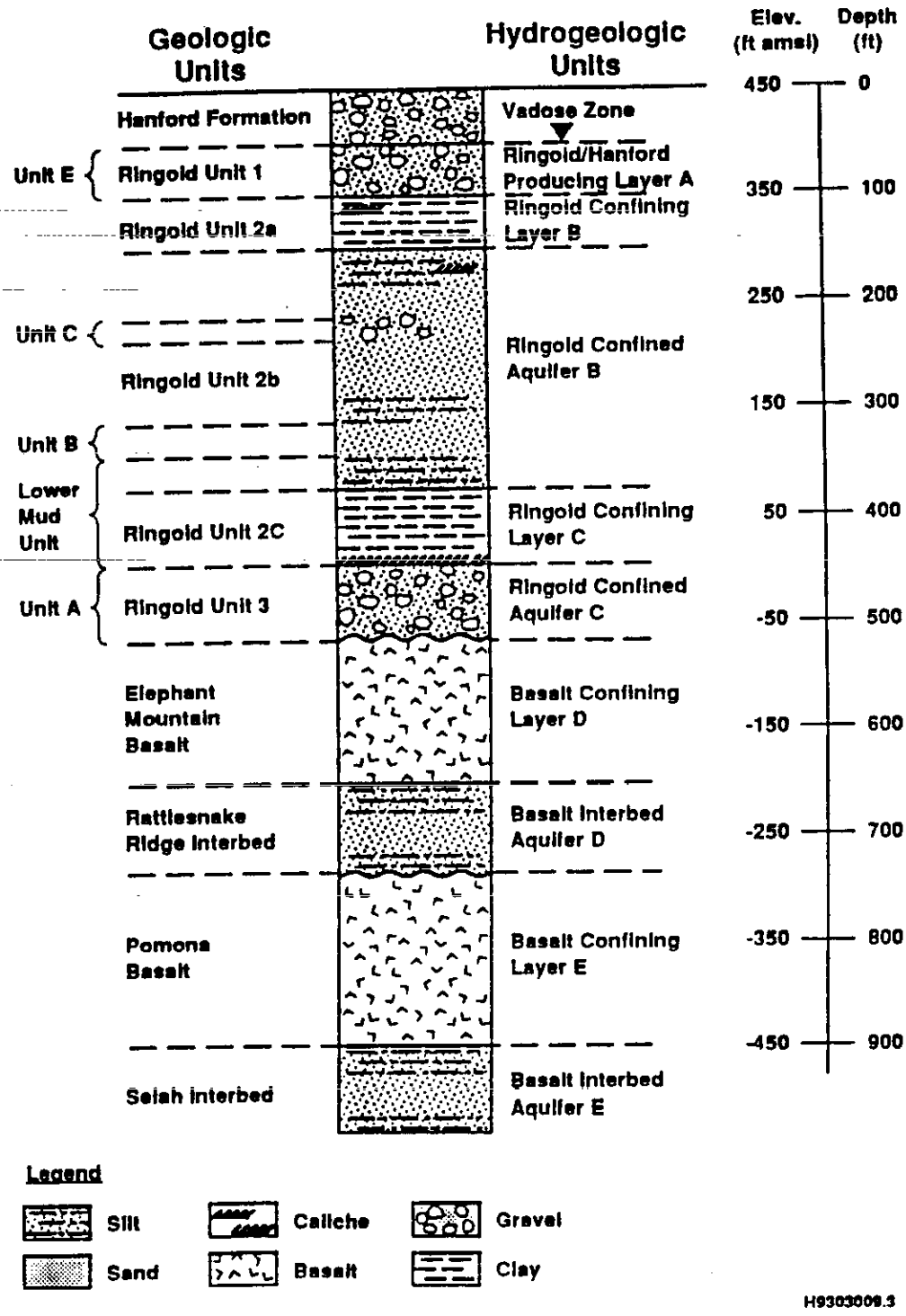
This section provides a categorical list of references for detailed studies on the regional background of the Hanford Site.

- Meteorology - Delaney et al. (1991) and PNL 1990
- Geology - Delaney et al. (1991)
- Hydrogeology - Liikala et al. (1988).

Stratigraphy of the 100 area (showing geologic and hydrogeologic columns) is shown in Figure 3-1. No impact to the subsurface geologic or hydrogeologic columns is expected from these activities.

No one resides on the Hanford Site. The working population of the 100-C and 100-K Area complex varies on a daily basis; generally, however, the population averages approximately 200 people per day in the area. Recreationists use the Columbia River throughout the year and have access to the west and south banks of the river. The nearest public road is State Highway 24, located 1.4 km (0.88 mi) from the closest 100 Area. The nearest resident to the 100-KE Area is located 16.2 km (10 mi) east of the reactor and across the Columbia River.

Figure 3-1. Geologic and Hydrogeologic Columns.



4.0 HAZARDOUS MATERIAL INVENTORY

The potential hazardous substance inventories associated with the decontamination and dismantlement activities for the basins are identified in Section 4.1. Potential contaminants of concern are contaminants loose or attached on the interior basin walls and ground surfaces.

4.1 RADIOLOGICAL CONTAMINANTS IN THE RETENTION BASINS

During reactor operation at the Hanford Site, effluent water was pumped into the retention basins from the reactors. After thermal decay, the water was either pumped back into the Columbia River or disposed of in cribs. Water disposed into cribs normally was contaminated with radionuclides above release limits. Because the contaminated water resided in the retention basins, contaminants have been deposited on the interior basin walls. The residual contamination attached on the interior walls consists of cobalt, cesium, and europium, with minor amounts of other radionuclides. Appendix B contains laboratory analyses and survey data of samples taken from the retention basins in 1993.

Portions of the surrounding substrate are also contaminated with radionuclides as a result of basin water leakage. Characterization studies were performed by Dorian and Richards (1978). The sludge in the retention basins is assumed to be indicative of contaminants that were introduced into the basin; Table 4-1 provides a list of radionuclides and concentrations (Dorian and Richards 1978). The data in Table 4-1 could be used to hypothesize the inventory on the interior basin walls. More recent laboratory analyses (performed in 1988 by WHC 183-K Health Physics Laboratory) indicate the inventory of concern for the 107-C basins, relative to removal of the basin walls, is the nuclides in Table 4-2. Tables 4-3 and 4-4 show the results of the laboratory analyses (performed in 1993) for the 107-KW and 107-KE retention basins. Table 4-5 shows the soil concentrations for comparison to activity found in rust and flume sediments.

The limiting radionuclide for the decontamination and dismantlement activities is ^{60}Co, based on quantity and specific activity. The calculations in Appendix B reflect the theoretical inventory based on the field survey data, laboratory analysis, and historical data. The worst-case inventory from the 107-C and 107-K retention basins is used to model maximum effect to the receptors of concern and the environment. Activity consequences at the 107-C retention basin and the highest values at the 107-K retention basin will be used to bound other scheduled basin activities.

Table 4-1. Nuclides Detected in 107-C Retention Basin Sludge.

Radionuclide	Average concentration in pCi/g
^{60}Co	3.8 E+03
^{90}Sr	2.9 E+03
Tritium	5.1 E+02
^{134}Cs	2.4 E+02
^{137}Cs	1.1 E+03
$^{239/240}Pu$	6.5 E+01
^{238}Pu	2.4 E+00
^{152}Eu	5.4 E-02
^{154}Eu	4.3 E+03
^{155}Eu	7.6 E+02
Uranium	1.1 E+00
^{63}Ni	2.7 E+03
^{14}C	1.8 E+02
Total curies in sludge = 9 curies	

Source: Dorian and Richards (1978).

Table 4-2. Samples Taken from the 107-C Retention Basin.

Radionuclide	Sample number A07C-00037	Sample number A07C-00038	Sample number A07C-00039
	Taken from metal beam/rod protruding from interior wall of east basin.	Taken from scale pile at ground/tank interface of east basin.	Taken near entrance ramp to west basin.
^{137}Cs	7.15 pCi/g	8.47 pCi/g	< 3.94 pCi/g
^{60}Co	2.51 E+01 pCi/g	2.31 E+01 pCi/g	1.97 E+01 pCi/g
^{152}Eu	4.66 E+02 pCi/g	9.17 E+02 pCi/g	3.54 E+03 pCi/g
^{154}Eu	5.52 E+01 pCi/g	1.12 E+02 pCi/g	4.29 E+02 pCi/g
^{155}Eu	Not detected	Not detected	1.97 E+01 pCi/g

Table 4-3. Samples Taken from the 107-KW Retention Basin.

Flume rust samples - GM and alpha/beta analysis results			
Sample number; length	Gross alpha	Gross beta	Gross gamma
1; 18 m (60 ft)	1.83 pCi/g	141.77 pCi/g	< 200 cpm
2; 45 m (150 ft)	1.38 pCi/g	165.32 pCi/g	< 200 cpm
Flume sediment samples - gamma spectroscopy analysis results			
—	^{60}Co	^{137}Cs	^{154}Eu ^{155}Eu
1; 18 m (60 ft)	4.77 pCi/g	8.64 E+01 pCi/g	<7.44 E+0-1 pCi/g <7.76 E+0-1 pCi/g
2; 45 m (150 ft)	1.48 E+01 pCi/g	1.51 E+02 pCi/g	<1.62 pCi/g <1.51 pCi/g

GM = Geiger Mueller.
cpm = counts per minute.

Table 4-4. Samples Taken from the 107-KE Retention Basin. (sheet 1 of 2)

Flume rust samples - GM and alpha/beta analysis				
Sample number; length	Gross alpha	Gross beta	Gross gamma	
1; 3 m (10 ft)	0.00 pCi/g	0.00 pCi/g	<200 cpm	
2; 45 m (150 ft)	1.83 pCi/g	1788.20 pCi/g	<200 cpm	
KE flume rust samples - gamma spectroscopy analysis results				
1; 3 m (10 ft)	^{60}Co	^{137}Cs	^{155}Eu	
2; 91 m (300 ft)	<1.15 pCi/g	<9.84 E-01 pCi/g	<2.22 pCi/g <1.33 pCi/g	
	1.41 E+02 pCi/g	2.00 E+01 pCi/g	9.86 E+01 pCi/g 6.39 pCi/g	
Flume technical smears - GM and alpha/beta analysis results				
30 m (100 ft)	5.35 E-03 dpm/cm^2	2.40 dpm/cm^2	<200 cpm	Note: Samples were counted for 1,000 seconds using the 47 mm filter low-level geometry for gamma spectroscopy (below).
0 m (200 ft) technical smear	0.00 dpm/cm^2	0.92 dpm/cm^2	< 200 cpm	
91 m (300 ft) technical smear	3.53 E-02 dpm/cm^2	3.86 dpm/cm^2	< 200 cpm	
121 m (400 ft) technical smear	0.00 dpm/cm^2	0.59 dpm/cm^2	< 200 cpm	
152 m (500 ft) technical smear	5.35 E-03 dpm/cm^2	3.64 dpm/cm^2	< 200 cpm	
105-KE 91 cm (36 in.) line	5.35 E-03 dpm/cm^2	0.30 dpm/cm^2	< 200 cpm	

Table 4-4. Samples Taken from the 107-KE Retention Basin. (sheet 2 of 2)

107-KE flume technical smears - gamma spectroscopy analysis results									
	^{60}Co		^{137}Cs		^{154}Eu		^{155}Eu		
30 m (100 ft) technical smear	<3.34	E-01 pCi/cm^2	<2.97	E-01 pCi/cm^2	<9.75	E-01 pCi/cm^2	<4.59	E-01 pCi/cm^2	
60 m (200 ft) technical smear	<3.02	E-01 pCi/cm^2	<2.62	E-01 pCi/cm^2	<8.28	E-01 pCi/cm^2	<4.18	E-01 pCi/cm^2	
91 m (300 ft) technical smear	<2.44	E-01 pCi/cm^2	<2.56	E-01 pCi/cm^2	<8.28	E-01 pCi/cm^2	<4.18	E-01 pCi/cm^2	
121 m (400 ft) technical smear	<2.44	E-01 pCi/cm^2	<2.14	E-01 pCi/cm^2	<8.28	E-01 pCi/cm^2	<4.11	E-01 pCi/cm^2	
152 m (500 ft) technical smear	<3.34	E-01 pCi/cm^2	<2.86	E-01 pCi/cm^2	<1.10	E-00 pCi/cm^2	<4.62	E-01 pCi/cm^2	
105-KE 91 cm (36 in.) line	<2.84	E-01 pCi/cm^2	<2.06	E-01 pCi/cm^2	<7.72	E-01 pCi/cm^2	<4.46	E-01 pCi/cm^2	

dpm = disintegrations per minute.

Table 4-5. Comparison for Rust/Sediment Samples to Soil Concentration Limits.

Radionuclide	Inaccessible soil concentration limits, pCi/g		Accessible soil concentration limits, pCi/g	
	100-BDNK	100-F,H	100-BDNK	100-F,H
^{60}Co	9.9 E+05	9.9 E+05	7.1 E+00	7.1 E+00
^{137}Cs	1.7 E+04	1.7 E+04	3.0 E+01	3.0 E+01
^{154}Eu	3.3 E+06	3.3 E+06	1.4 E+01	1.4 E+01
^{155}Eu	2.3 E+07	2.3 E+07	6.3 E+02	6.3 E+02

Source: WHC-CM-7-5, *Environmental Compliance Manual*.
BDNK = 100-B, 100-D, 100-N, and 100-K Areas.

4.2 CHEMICALLY CONTAMINATED SLUDGE IN 107-C RETENTION BASIN

The nonradiological hazardous substances could consist of a wide range of substances with varying concentrations. Tables 4-6 and 4-7 provide data on chemical and metal contaminants detected during sludge characterization in the 107-C retention basin.

Table 4-6. Chemical Species Detected During Sludge Characterization in the 107-C Retention Basin.

Chemical contaminant	Concentration
Methyl ethyl ketone	5.00 ug/kg
Pentachlorophenol	920.0 ug/kg*
Fluoranthene	67.0 ug/kg*
Benzo(b)anthracene	77.0 ug/kg*
Chrysene	100.0 ug/kg*
Benzo(B)fluoranthene	100.0 ug/kg*
Benzo(K)fluoranthene	100.0 ug/kg*

Source: DOE-RL 1993b.
*Estimated value concentration is less than detection limit.

Table 4-7. Metals Detected During Sludge Characterization in the 107-C Retention Basin.

Constituent	Concentration in mg/kg
Copper	46.8
Iron	42,800
Lead	564.0
Chromium	609.0*
Zinc	309.0
Mercury	4.3

Source: DOE-RL 1993b.
*Estimated value concentration is less than detection limit.

Because the sludge inventory will not be encroached upon, the inventory at risk are those contaminants attached or loose on the interior metal walls of the retention basins or on the ground surfaces. Further surveys and analyses were performed to determine what inventory was available for resuspension via the decontamination system selected. The inner basin walls have not been sampled for chemical contaminants; it is assumed that years of exposure to the elements have stripped soluble contaminants from the inner surfaces. During decontamination activities, air monitoring will occur to verify absence or presence of chemical species (lead, chromium, and total particulates). The commitment in Section 5.0 specifies that if an action level for any contaminant is approached via monitoring, work shall stop and an unreviewed safety question process shall be initiated. The inventory available for resuspension would be bounded by those radionuclides attached to the basin inner wall and ground surface.

The chemical hazards (lead-based paint) associated with the dismantlement activities are anticipated to be commensurate with hazards that may be encountered in any construction project; these hazards generally are accepted

by the public. The extremely low concentrations of chemically hazardous substances and the relatively small volumes of soil materials permit the classification of a low-hazard activity. To ensure the activities are conducted in a low-hazard regime and minimizes the potential hazards to individuals and the environment, decontamination activities involving contaminated spot removal on the exterior basin wall will use the Occupational Safety and Health Administration (OSHA) requirements in 29 CFR 1926. The lead emission hazards associated with paint removal shall not exceed any reportable quantity in 40 CFR 117, 302, and 355.

5.0 HAZARD ASSESSMENT

The hazards associated with the decontamination and dismantlement of the retention basins is consistent with a radiological classification activity based on the nuclide thresholds in current guidelines (DOE 1992a and DOE 1992b). The potential radiological consequences associated with these dismantlement activities are similar to those encountered during excavation of the 116-F-4 Pluto Crib. The difference between the crib and the retention basin activities is contaminants were attached to soil particles in the crib; contaminants in the basin, however, are attached to the inner walls. The commonality for release energy is the movement of air entraining contaminants during the dismantlement activities.

The major mechanism for release of contaminants is via an airborne pathway. The calculations indicate that because water is added to the grit-blast system, potential airborne releases are minimized to the maximum extent possible. As derived by analysis, 100 x the maximum detected activity will not exceed 1/10 of a derived air concentration (DAC) for the facility worker or exceed the derived concentration guide (DCG) for the Hanford Site worker or the public. Current WHC institutional controls (WHC-CM-4-40, WHC-CM-4-3, and WHC-CM-1-6) will more than adequately protect the facility worker from undue risk associated with these basin activities. Access to and egress from the activity work area will be controlled by the Radiation Work Procedure that is consistent with WHC institutional controls and sensible work practices.

A criticality event was considered incredible and dismissed from lack of sufficient inventory for fission to occur.

Waste control will require that used grit remain in place; final disposition of the grit has not been determined. Because the retention basins are designated as waste sites and because final closure has not been determined, the preferred alternative is to leave the used grit in place and stabilize until final closure. The use of water to minimize airborne emissions is addressed in WHC-CM-7-5. A spill of water at the site was evaluated and determined to have only localized consequences.

An assessment of a worst-case hypothetical accident shows the potential release concentrations of chemically hazardous substances will not be an issue as there are no indications that interior basin walls are contaminated with hazardous chemicals. Rust on the interior basin walls indicates the absence of chemically-hazardous rust inhibitors used in the past. It is assumed that any residual soluble chemicals on the walls have been weathered away or concentrated in the sludge. Spot decontamination on the exterior lead-based paint will emit particulates. Analysis indicates emissions will be below reportable quantities. Worker protection issues are adequately addressed in 29 CFR 1926. Air monitoring as well as field surveys by health physics technicians will occur during all basin activities. If (radiological/chemical/metal) contaminants are detected via the monitoring system that approach any action level, activities shall cease and a unreviewed safety question process will be initiated.

5.1 EFFECT OF NATURAL PHENOMENA

The effect of natural phenomena on the decontamination and dismantling activities was addressed. It is inconceivable that the potential contaminants could impact the receptor groups in the event of a natural disaster. If a natural event were to occur with sufficient energies to damage structures within the complex, the contaminants of concern would be minuscule compared to the inventories within the total retention basin complex. This conclusion is further confirmed by the dispersion model in Appendix D.

Natural phenomena events such as floods, tornados, seismic events, and lightening would not have significant adverse effects that would increase the hazards associated with basin dismantlement and stabilization activities. Statistics and probability scopes for these events at the Hanford Site are provided in Lehrschall (1992).

High wind speeds up to 180 km/hr (112 mi/hr) are credible for the Hanford Site (>10 x 10^6/yr) (Kennedy et al. 1990). Normal wind speeds of 4.8 km/hr (3.0 mi/hr) were found not to have an effect. Winds below 12 mi/hr are not capable of entraining contaminants. An analysis at the BX-102 site involving a fractional release of the highest concentrations of radionuclides from 3 drive barrels exposed to a 24 km/hr (15 mi/hr) wind for 1 hour and 8 hours found the consequences to the onsite worker and public to be insignificant (Lehrschall 1992). Basin activities would be expected to encounter concentrations of nuclides in nCi to pCi per gram range compared to the uCi/g concentrations at the BX-102 site. The 24 km/hr (15 mi/hr) wind speed is the maximum wind speed under which outdoor work activities are allowed. Missiles generated by high winds could produce hazards to workers at the activity site or damage support equipment. However, because of the type of activities performed, high winds would not lead to surface spills or add significant airborne inventories. The consequences associated with high winds/missiles would be bounded by the maximum release event.

6.0 OPERATIONAL SAFETY LIMITS

An OSL is an auditable limit established for the safe operation of a low hazard environmental remediation activity. The U.S. Department of Energy, Richland Operations Office has a policy that at least one safety control will be established to ensure the facility or activity is performed safely and within the bounds of safety documentation.

This safety assessment depends on very low concentrations of contaminants during the decontamination and dismantlement of the retention basins. Radiological surveys, air sampling, and sampling for volatile organic compounds will ensure the limits specified in the assessment (Section 5.0) are within the values specified in OSL-1, paragraph 1.1. This OSL will ensure that the requirements in the Washington Administrative Code are met to prevent further environmental insult.

6.1 OPERATIONAL SAFETY LIMITS

OPERATIONAL SAFETY LIMIT 1

1.	TITLE:	Inventory Limit for Grit-Blasting Activities at the 107-C, 107-KE, 107-KW, and 107-F Retention Basins.
1.1	OPERATIONAL SAFETY LIMIT:	During decontamination and dismantlement activities at the retention basins, the potentially hazardous radionuclide inventory will be limited to the maximum of 4×10^6 dpm/100 cm^2 beta/gamma direct-fixed plus smearable levels for open-air, grit-blasting activities.
1.2	APPLICABILITY:	This limit applies to contamination attached to the interior and exterior basin walls and piping that are subject to open-air, grit-blasting decontamination.
1.3	OBJECTIVE:	To ensure that decontamination and dismantling activities of the retention basins are conducted within the bounds of this safety assessment, and the potential hazards to individuals and the environment are minimized to as low as reasonably achievable.
1.4	REQUIREMENT:	Basin sections to be decontaminated shall be surveyed at a frequency determined by Health Physics that will ensure compliance with this OSL.
1.5	SURVEILLANCE:	All phases of the activities shall be inspected by qualified personnel to ensure the specified limits of control are not exceeded. Survey results shall be documented and verifiable.

1.6 NONCOMPLIANCE WITH OSL REQUIREMENTS:

a. Implement the appropriate radiological controls for the basin if field instrumentation indicate levels in excess of allowed limits.

b. If these safety requirements are not complied with, cease all open-air, grit-blasting activities. Activities shall resume when a recovery plan has been prepared and approved by line management with concurrence by Safety Assurance.

c. If no monitoring personnel are at the activity site, all grit-blasting activities shall not commence until monitoring personnel arrive. Activities shall resume when concurrence is received from Site Safety and Health Physics.

d. Document the OSL violation per the applicable management requirements and procedures.

1.6.1 NONCOMPLIANCE WITH THE SURVEILLANCE REQUIREMENT

a. Perform surveillance immediately to ensure there has been no spread of contamination.

b. If noncompliance with the controls in paragraph 1.4 of this OSL are observed during surveillance, implement recovery actions in paragraph 1.6 of this OSL.

c. Document the failure to implement surveillance requirements per the applicable management requirements and procedures.

1.7 RECOVERY: If contamination in a basin section is above the limits specified in paragraph 1.1 of this OSL, cease activities for that basin section. Implement confinement procedures to mitigate the spread of contamination.

1.8 AUDIT POINT: Maintain radiological surveys and log entries indicative of contamination levels encountered during decontamination and dismantlement activities.

1.9 BASIS: This OSL limits radiological inventories to ensure decontamination and dismantlement activities are conducted below the criteria for a Category 3 radiological hazard activity.

OPERATIONAL SAFETY LIMIT 2

2.	TITLE:	Requirements for Water Injection During Grit-Blasting Activities.
2.1	OPERATIONAL SAFETY LIMIT:	Ensure sufficient water is available to support grit-blasting activities. Water injection is necessary to mitigate airborne contaminants.
2.2	APPLICABILITY:	This limit applies to grit blasting removal of contamination attached to the interior and exterior basin walls and piping that are subject to be decontaminated.
2.3	OBJECTIVE:	To ensure that decontamination and dismantling activities of the basins are conducted within the bounds of this safety assessment, and the potential hazards to the receptor groups and the environment are minimized to as low as reasonably achievable.
2.4	REQUIREMENT:	Ensure the grit-blast system has sufficient water available to support decontamination activities of basin walls and piping.
2.5	SURVEILLANCE:	Qualified experts shall inspect all phases of the decontamination and dismantling activities to ensure sufficient water is used in grit blasting such that decontamination of a basin section does not exceed the limits specified in paragraph 1.1 of OSL-1. Document the results of periodic inspections (e.g., hose integrity, water levels, and flow meters).

2.6 NONCOMPLIANCE WITH OSL REQUIREMENTS

a. If inspection indicates water has been depleted below allowable limits for the unit, implement the appropriate radiological controls.

b. Cease grit-blasting activities if these safety requirements are not complied with. Activities shall resume when a recovery plan has been prepared and approved by line management with concurrence by Safety Assurance.

c. If no monitoring personnel are at the activity site, cease grit-blasting activities until monitoring personnel arrive. Activities shall resume when concurrence is received from Site Safety and Health Physics.

d. Document the OSL violation per the applicable management requirements and procedures.

2.6.1 NONCOMPLIANCE WITH THE SURVEILLANCE REQUIREMENT

a. Perform surveillance immediately to ensure there is sufficient water to continue, or cease grit-blasting activities.

b. If noncompliance with the requirements in paragraph 2.4 of this OSL are observed during surveillance, implement recovery actions in paragraph 2.7 of this OSL.

c. Document the failure to implement surveillance requirements per the applicable management requirements and procedures.

2.7 RECOVERY: If mitigative resources are below the limits specified in paragraph 1.1 of OSL-1, cease activities for that basin section. Implement appropriate radiological controls to mitigate the spread of contamination.

2.8 AUDIT POINT: Maintain log or checklist entries indicative of mitigative operating parameters encountered during decontamination and dismantlement activities.

2.9 BASIS: This OSL limits grit-blasting activities such that sufficient mitigative resources are available to ensure that decontamination/dismantlement activities are conducted below the criteria for a Category 3 radiological hazard activity.

7.0 REFERENCES

DOE, 1988, *Radiation Protection for Occupational Workers*, DOE Order 5480.11, U.S. Department of Energy, Washington, D.C.

DOE, 1992a, *Nuclear Safety Analysis Reports*, DOE Order 5480.23, U.S. Department of Energy, Washington, D.C.

DOE, 1992b, *Hazard Characterization and Accident Analysis Techniques for Compliance with DOE Order 5480.23 Nuclear Safety Analysis Reports*, DOE-STD-1027-92, U.S. Department of Energy, Washington, D.C.

DOE-RL 1993a, *Hanford Site Hoisting and Rigging Manual*, DOE-RL 92-0036, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL 199b, *Limited Field Investigation Report for the 100-BC-1 Operable Unit*, DOE-RL 93-0006, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Delaney, C. D., K. A. Lindsey, and S. P. Reidel, 1991, *Geology and Hydrology of the Hanford Site: A Standardized Text for Use in Westinghouse Hanford Company Documents and Reports*, WHC-SD-ER-TI-003, Westinghouse Hanford Company, Richland, Washington.

Dorian, J.J., Richards, R., 1978, *Radiological Characterization of the Retired 100 Areas*, UNI-946, U.S. Department of Energy, Washington, D.C.

Kennedy, R. P., S. A. Short, J. R. McDonald, M. W. McCann, R. C. Murray, J. R. Hill, 1990, *Design and Evaluation Guidelines for Department of Energy Facilities Subjected to Natural Phenomena Hazards*, UCRL-15910, U.S. Department of Energy, Washington, D.C.

Lehrschall, R. R., 1992, *Safety Assessment for Environmental Investigations and Site Characterizations, Volume 1: Activities Involving Drilling and Sampling of Contaminated Soils*, WHC-SD-EN-SAD-016, Rev. 0, Vol. 1, Westinghouse Hanford Company, Richland, Washington.

Liikala, T. L., R. L. Aaberg, N. J. Aimo, D. J. Bates, T. J. Gilmore, E. J. Jensen, G. V. Last, P. L. Oberlander, K. B. Olsen, K. R. Oster, L. R. Roome, J. C. Simpson, S. S. Teel, and E. J. Westergard, 1988, *Geohydrologic Characterization of the Area Surrounding the 183-H Solar Evaporation Basins*, PNL-6728, Pacific Northwest Laboratory, Richland, Washington.

PNL, 1990, *Climatological Summary of Wind and Temperature Data for the Hanford Meteorology Monitoring Network*, PNL-7471, 1990, Pacific Northwest Laboratory, Richland, Washington.

Smith, D.L., 1993, *Alternative Evaluation for the 107-KE, 107-KW, 107-C, and 107-F Retention Basins Decontamination and Interim Stabilization*, WHC-SD-DD-TI-085, Westinghouse Hanford Company, Richland, Washington.

29 CFR 1910, 1993, "Occupational Safety and Health Standards," *Code of Federal Regulations*, as amended.

29 CFR 1926, 1993, "Lead Exposure in Construction; Interim Final Rule," *Code of Federal Regulations*, as amended.

40 CFR 117, 1993, "Determination of Reportable Quantities for Hazardous Substances," *Code of Federal Regulations*, as amended.

40 CFR 302, 1993, "Design, Reportable Quantities, and Notification," *Code of Federal Regulations*, as amended.

40 CFR 355, 1993, "Emergency Planning and Notification," *Code of Federal Regulation*, as amended.

WHC-CM-1-6, *WHC Radiological Control Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-4-46, *Nonreactor Facility Safety Analysis Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-4-3, *Industrial Safety Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-4-40, *Industrial Hygiene Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-7-5, *Environmental Compliance Manual*, Westinghouse Hanford Company, Richland, Washington.
Section 3.7, "Environmental Compliance."

APPENDIX A

HEALTH PHYSICS PROCEDURES

This page intentionally left blank.

WESTINGHOUSE HANFORD COMPANY	Manual	WHC-IP-0718
	Section	3.1.1, Rev. 0
	Page	1 of 5
HEALTH PHYSICS PROCEDURES	Effective Date	July 31, 1993
	Organization	ESQ/Health Physics
TITLE:	Approved by	
MATERIAL RELEASE SURVEYS	W. C. Mallory, Manager Radiological Engineering	

1.0 PURPOSE AND SCOPE

This procedure provides the Health Physics Technician (HPT) with guidance and requirements for performing and documenting surface contamination release surveys of material and equipment.

2.0 PREREQUISITES

- HPT academic and fundamentals training
- Instrument background and minimum detectable activity (MDA), or minimum detectable count rate (MDCR), has been determined

3.0 PRECAUTIONS/LIMITATIONS

3.1 This procedure does **NOT** apply to materials that have been contaminated in depth or volume.

3.2 Materials used or stored in Contamination, High Contamination, or Airborne Radioactivity Areas shall be surveyed by an HPT prior to release to a Radiologically Controlled Area (RCA).

3.3 Materials used or stored in Radioactive Material Area (RMA), Radiological Buffer Area (RBA), or RCA shall be evaluated and surveyed by an HPT prior to release to Uncontrolled Areas. This evaluation will determine: 1) if the material has been contaminated under any coatings and 2) the isotopes of concern.

3.4 Background limits for direct surveys with portable/semi-portable count rate meter (CRM) instruments:

- Less than 150 cpm beta-gamma with a CRM and G-M pancake probe
- Less than 3 cpm alpha (audible pop per minute) with a PAM, or a PAC-6, or a Poppy

NOTE: Total contamination is equal to fixed plus removable contamination.

3.5 Surface Contamination Release Limits for transuranic isotopes and mixed fission products are provided below. Refer to WHC-CM-1-6, Table 2-3 for specific isotopes and their limits.

- Less than 20 dpm/100 cm^2 alpha removable contamination
- Less than 500 dpm/100 cm^2 alpha total contamination
- Less than 1000 dpm/100 cm^2 beta-gamma removable contamination
- Less than 5000 dpm/100 cm^2 beta-gamma total contamination

NOTE: Where an approved characterization study identifies that an "*α only*" or a "*β only*" contamination survey is sufficient, the other type of survey may be omitted.

3.6 Objects with inaccessible surfaces may be released if:

- There is no reasonable mechanism for contamination to be transported to the inaccessible surfaces of the object (example: the object has no internal fans or flow-through openings
- The object is determined to be free of contamination on its accessible surfaces by a 95% statistical survey before any decontamination efforts are undertaken

4.0 REQUIRED EQUIPMENT/MATERIALS

- Wipe material
- Contamination survey instruments
- Counting (scaler) instruments or bench top counters (optional)

5.0 PROCEDURE

5.1 Determine If the Material is a Candidate for Release.

5.1.1 Review the material criteria presented in the following table to determine the level of survey required.

MATERIAL CRITERIA	LEVEL OF SURVEY REQUIRED
1. Has never come into contact with unsealed radioactive sources AND has never been used or stored in any of the following: • Contamination Area • High Contamination Area • Airborne Radioactivity Area	May be released without a contamination survey (exempt facilities), unless specified by the HP Supervisor. The Material History Release form shall be used to document this release.
2. • Has been aggressively decontaminated (review 3.6 above) -OR- • Is likely contamination free (but cannot be released based on history alone)	Large Area Wipe on accessible surfaces. For surface areas: • greater than 300 ft^2, split into areas > 300 ft^2 and go to the next bullet • 5 to 300 ft^2, perform at least 60 static direct survey measurements • less than 5 ft^2, perform static measurements on locations likely to be contaminated and a slow scan (1 in./sec) of the rest
3. Has been decontaminated by non-aggressive techniques (review 3.6 above)	May be released based on a 100% contamination survey, large area wipe and slow scan

5.2 Perform a Large Area Wipe Survey and Determine the Wipe Activity.

NOTE: In lieu of counting instruments, portable instruments may be used.

5.3 Perform a Direct Survey.

5.3.1 Perform release surveys using 5 to 6 second static (contact) measurements and, if required, perform a slow scan--1 inch/second at 0.25 inches or less from the surface.

5.4 Determine the Material Status.

NOTE: Using the survey methods in this procedure, when activity is above portable/semi-portable instrument background or activity is above detectable counting limits the "survey results are positive." Conversly, when there is no detectable activity on both the portable/semi-portable and counting instruments the "survey results are negative."

5.4.1 If the survey results are positive:

- Tag or label the material as Radioactive Material
- Package the material, as appropriate
- Ensure the material is under radiological controls
- If a MATERIAL HISTORY RELEASE form is used, line through and initial contaminated items

5.4.2 If the survey results are negative:

1. Record the portable/semi-portable instrument survey results as less than the surface contamination limits in 3.5 above

2. Record the counting instrument survey results as less than the detection limits

3. Complete one of the following:

A. If the material is released to a RCA, attach a Radiation Release label to the material.

-OR-

B. If the material is released to an Uncontrolled Area:

- Verify the MATERIAL HISTORY RELEASE form has been completed
- If applicable, evaluate the material per 3.3 above and go to step 5.3.1 through this step to re-survey the material
- If the material is NOT going offsite, attach a Radiation Release label to the material
- If the material is released for unrestricted use (to the public), remove all Radiation Release labels (deface those that could not be removed) as applicable

NOTE: Material not immediately removed after being surveyed shall be controlled to prevent radioactive contamination while awaiting its release.

5.5 Document Material Information on a Radiation Survey Report.

6.0 BIBLIOGRAPHY

WHC-CM-1-6, WHC Radiological Control Manual, Articles 421-423

WHC-CM-4-12, Health Physics Practices, Sections 6.3 and 11.1

PNL-MA-562, Radiation Protection Instrument Manual, EGM-PAM & PAC-6

[HP] Internal Memo, EXEMPTIONS FROM RADIATION PROTECTION RELEASE

7.0 ATTACHMENTS

None

8.0 DOCUMENTATION

Radiation Survey Report (form number BD-6000-010)

Radiation Survey Report log

Smear Sample Counter log (form number A-6000-273 or JetForm), when used

Material History Release form (form number under development), when used

NOTE: Material custodians may use the Material Release History Record form (A-6000-343 or macro WEF178), until the Material History Release form becomes available.

This page intentionally left blank.

APPENDIX B

SUPPORTING CALCULATIONS

This page intentionally left blank.

RADIOLOGICAL

The concentrations of contaminants on the retention basin walls to be decontaminated are assumed to be consistent with current field survey data. The distribution of contamination is not uniform over the interior walls of the retention basins. The highest activity level on the walls has been calculated by conservatively assuming the level is uniform over a small area of the upper section of a wall (referred to as a "bathtub ring"). Cobalt-60 is also assumed to be the limiting radionuclide. Because a volume of air surrounding the grit-blasting activities is required for concentration calculations, the volume of air passing through the grit-blast system is assumed to contain all particulate contamination.

Where

40,000 dpm/100cm^2 beta/gamma= highest levels detected. For analysis and for the OSLs in Section 6.0, that amount was multiplied by 100.

4,000,000 dpm/100 cm^2 beta/gamma = average activity on the wall bathtub ring.

The following calculations shall be used for the grit-blasting activities:

8.92 x 10^6 cm^3/min (315 ft^3/min) = air flow through grit blaster.

NOTE: 315 ft^3 is equivalent in volume to a right circular cylinder 6 ft high by 8 ft in diameter. (The air flow through the system per minute is roughly equivalent to a breathing zone for an individual).

1.39 x 10^4 cm^2/min (15 to 20 ft^2/min) = blast area (footprint for decontamination).

1.39 x 10^4 cm^2/min = 139 sections (sized 100 cm^2) per minute are decontaminated.

(139 100 cm^2) x (4,000,000 dpm/100 cm^2) = 5.56 x 10^8 dpm released per minute.

If all activity is ^{60}Co, $\frac{5.56 \times 10^8 \text{ dpm}}{2.51 \times 10^{15} \text{ dpm/g (specific activity)}}$ = 2.22 x 10^{-7} g
x (1.13 x 10^3 Ci/g) = 2.51 x 10^{-4} Ci/minute dispersed into the air volume passing through the grit-blast system (unmitigated).

Where

^{90}Sr = 4.8 x 10^{-8} Ci/minute (unmitigated based on gross beta smear data in Table 4-4).

^{239}Pu = 3.35 x 10^{-11}Ci/minute (unmitigated based upon gross alpha smear data in Table 4-4).

8.92×10^{6} cc/minute = volume of air discharge from grit-blast nozzle.

2.51×10^{-4} Ci/min = 25.1×10^{1} uCi/min.

Therefore

$$\frac{25.1 \times 10^{1} \text{ uCi/min}}{8.92 \times 10^{6} \text{ cc/min.}} = 2.81 \times 10^{-5} \text{ uCi/cc per minute of operation}$$

$(2.81 \times 10^{-5}) \times (0.0001) = 2.81 \times 10^{-9}$ uCi/cc
(0.0001 is a particulate reduction factor discussed below).
(0.0005 reduction factor equates to 1.405×10^{-8} uCi/cc; respiratory protection is required for this concentration).

Assuming the grit is dry, 2.81×10^{-5} uCi/cc is the theoretical concentration of particulate ^{60}Co generated per minute and confined in the volume of air passing through the grit-blast system. A test was performed in 1993 to determine the decrease in airborne particulates that occurred by adding water to the grit-blast system (test data attached). OSHA (29 CFR 1926) has determined that for lead particulates generated by abrasive blasting, a concentration of approximately 58,700 ug/m^3 could be generated. The test found 8-9 ug/m^3 lead, or a 99.99% reduction of particulates emitted to the atmosphere.

Therefore, only 0.01% of the original inventory available is expected to become airborne (or 2.81×10^{-9} uCi/cc/min) at the activity site. This concentration is less than the requirement for respiratory protection at 1/10 of a DAC for ^{60}Co or 7.0×10^{-9} uCi/cc.

Attached are the results of modeling a release for impact to uninvolved onsite workers and the public. The basis for screening is the derived concentration guide (DCG). It is assumed that two grit-blasting units will be in operation at one time; therefore, a 7.4×10^{-13} g/s release rate is assumed with wind speed at 6.3 m/s. By model, the concentration for ^{60}Co is 8.0×10^{-13} mg/m^3 at 100 m.

8.0×10^{-13} mg/m^3 = 8.0×10^{-19} mg/cc or 8.0×10^{-21} g/cc

$(8.0 \times 10^{-21}$ g/cc) x [$(1.13 \times 10^{3}$ Ci/g)(specific activity)]
= 9.04×10^{-19} Ci/cc

9.04×10^{-19} Ci/cc = 9.04×10^{-13} uCi/cc at 100 m

9.04×10^{-13} uCi/cc is less than the DCG or DAC for receptors not involved in the activity = DCG

Environmental release equals the amount of radionuclide emitted each minute multiplied by a reduction factor of 0.01%, multiplied by the number of minutes in an 8-hour day (no effort was made to factor in down-time as a result of equipment malfunction, inspection down-time, personnel rest breaks, maintenance, etc.)

Therefore

^{60}Co = 1.2×10^{-5} Ci/8-hour work day (reportable quantity = 10 Ci)

^{90}Sr = 2.3×10^{-9} Ci/8-hour work day (reportable quantity = 0.1 Ci)

^{239}Pu= 1.61×10^{-12} Ci/8-hour work day (reportable quantity = 0.01 Ci)

Reportable quantity source: 40 CFR 302.4, Appendix B

TOXICOLOGICAL

The following are estimates for concentration of lead particulates.

Field characterization data using a MAP Spectrum Analyzer[1] has detected lead concentrations of 0.00 mg lead/cm^2 to 0.6 mg lead/cm^2 of paint on the exterior basin walls. Based on this data, the following were calculated.

Where

4.57×10^2cm (15 ft) x 3.66×10^2cm (12 ft) = 1.67×10^5 cm^2
Area of door (the door exhibited worst-case painted exterior).

(1.67×10^5 cm^2) x (.6 mg lead/cm^2) = 1.00×10^2 g (0.22 lb) lead in painted surface to be removed.

The reportable quantity for lead is 10 lb in a 24-hour period. This activity will not violate lead criterion in Reference 1. Based on the calculations above, inventory lead emissions are not expected to reach reportable quantities. Only spot decontamination of exterior will be done and the area affected will not approach 1.67×10^5 cm^2 in any 24 hr period.

Field tests were conducted on the doors in December 1993; test results indicate the time weighted average (TWA) for lead in air will not be reached. (See attached analysis from air monitoring). The OSHA rule (dated May 1993) for lead exposure in construction indicates that worst case abrasive blasting could generate lead levels up to 58,700 ug/m^3 (29 CFR 1926). The minimum value for grit blasting was 1,352 ug/m^3 with a maximum value of 58,700 ug/m^3. The arithmetic mean for 26 observations was 17,315 ug/m^3. The action level for lead is 30 ug/m^3 TWA and the permissible exposure limit for lead is 50 ug/m^3 averaged over an 8-hour day. Based on maximum generated lead concentrations in 29 CFR 1926 and the results of monitoring data, water use reduces the concentrations by approximately 99.99% (see results from the December test in Appendix C).

$$\frac{9.1 \text{ ug/m}^3}{58{,}700 \text{ ug/m}^3} = 0.0001, \text{ or } 99.99\% \text{ reduction.}$$

If the arithmetic mean were used, the corresponding reduction would be 99.95% and a 99.4% reduction if the lowest number were used.

[1]Map Spectrum Analyzer is a tradename of Scitec Corporation.

Preliminary results of lead exposure monitoring conducted on January 7, 1994 are provided below. Monitoring was conducted at the 100 K Basins during testing of a wet grit-blast system. Please reference your request for service #93-0097

sample result	0.031 mg/m3	
sample duration	132 minutes	
sample volume	396 liters	
8 hour time weighted average exposure		0.0085 mg/m3

sample result	0.033 mg/m3	
sample duration	133 minutes	
sample volume	404 liters	
8 hour time weighted average exposure		0.0091 mg/m3

The current OSHA permissible exposure limit for lead is 0.05 mg/m3 as an 8 hour time weighted average exposure.

APPENDIX C

RADIATION SURVEY REPORT

This page intentionally left blank.

Westinghouse Hanford Company

RADIATION SURVEY REPORT

Date: 7-22-93 | Time: From 0830 To 1100 | Survey Number: № 128391 | FC: DD | Page 1 of 2

Bldg: NA | Area: 100-C | Room: NA

Description of Job: General survey of area and sampling of Rust from Basin walls

RWP No.: DD-T-032 | Location: Retention BASINS

Check if appropriate. When checked, do not place unrelated information on this record

- ☐ Personnel Contamination
- ☐ CAM/Radiation Alarm
- ☐ Establish Dose Rates
- ☐ Radiation/Contamination Incident
- ☐ High Radiation Level Work
- ☒ "Special Survey"
- ☐ Property Release
- ☐ RAM Shipment

Item No.	PER (1)	Description of Work Performed, Radiation Controls, and Measurements	Meter Deflection W/O	Meter Deflection W/C	Dist	C.F.	DOSE RATE beta (non pen) mrad/hr	DOSE RATE gamma (pen) mR/hr	DOSE RATE neutron mrem/hr	CONTAMINATION LEVELS Direct (dpm) beta	Direct (dpm) alpha	Smear 100 cm² beta (d/m)	Smear 100 cm² alpha (d/m)	mrad/hr
1		General Area inside TANKS	<.5	<.5	F	—	<.5	<.5						
2		3' up on inner wall (general)			C	—				2K-10K	<D			
3		10' up on inner wall (general)			C	—				10K-40K	<D			
4		Basin 1 Hot vegetation	2		C	—	2	<.5		500K	<D			
5		Basin 2 Hot vegetation			C	—				50K	<D			
6		3 Samples		<.5	C	—		<.5						
7		tools			C	—				<D		<D		
8		personnel			C	—				<D				

(1) Check for personnel dose rate ☐ Continued on supplemental report form

Instrument(s) Used	☒ CP	☒ G-M/Pancake	☒ PAM	☐	☐	☐
Serial No.(s)	6199	1357 173	2475			

Respiratory Protection Worn

- ☐ Supplied Air
- ☐ Filter
- ☐ Other
- ☒ None

ESTIMATED PERSONNEL DOSE RATES

Phase of Work	Based on Measurement(s)	Average Dose Rate	Limit Applying
NA			WBP S E
			WBP S E
			WBP S E

RPT Exposure: NA | Work Location Code: NA | Signed | PR No 81511

Did you increase or reduce RWP requirements for this work? ☒ No ☐ Yes Explain on reverse side

Did you attend a pre-job meeting for this work? ☐ N/A ☐ No ☐ Yes

Reviewed By | Date 7/26/93

C-1

WHC-SD-EN-SAD-027, REV.0

RADIATION SURVEY REPORT (cont.)

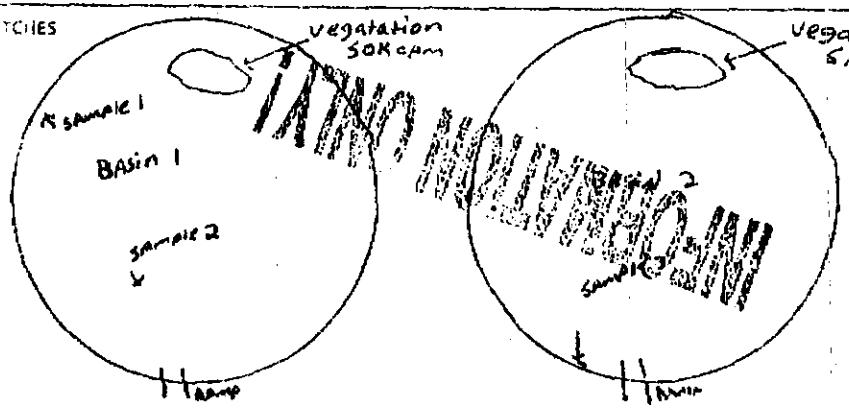
Survey Number: №128391 | F.C: DD | Page 2 of 2

Further Descriptions, Data, and Comment

Both TANKS were ~~see~~ A.S. 7-22-93 contaminated approximately in the same areas with the A.S. 7-22-93 approximately the same levels. The Samples and laundry were left in the surface area because NO RSR was available.

NA

DIAGRAMS OR SKETCHES



ADDITIONAL REPORTS COMPLETED

	Log No.		Log No.
Radiological Problem Report	NA	Onsite Radioactive Shipment	NA
Skin Contamination Survey		Offsite Radioactive Shipment	
Personnel Effects Contamination Report		Routine Radioactive Shipment	
Radiation Survey Report		Sample Counter Log	

BD-6000-010R (10.90)

C-2

WHC-SD-EN-SAD-027, REV.0

SAMPLE STATUS REPORT FOR E 830. E-BLANK A07C38 TIME: 8/18/93 11:14
DISPATCHED: 7/27/93 13:49 SAMPLE HAS NOT BEEN SLURPED
RECEIVED: 7/28/93 13: 0

EXT.	DETER.	RESULTS OR STATUS		OUT OF RANGE?	GOOD ANS?	CHARGE CODE
2182	GEA-V&A	8.47000E 00 pCi/G	Cs-137	N	Y	VOGEL
2182	GEA-V&A	2.31000E 01 pCi/G	Co-60	N	Y	VOGEL
2182	GEA-V&A	9.17000E 02 pCi/G	Eu-152	N	Y	VOGEL
2182	GEA-V&A	1.12000E 02 pCi/G	Eu-154	N	Y	VOGEL

END OF REPORT

9443275.0086

SAMPLE STATUS REPORT FOR E 831. E-BLANK A07C39 TIME: 8/18/93 11:59
DISPATCHED: 7/27/93 13:50 SAMPLE HAS NOT BEEN SLURPED
RECEIVED: 7/28/93 13: 1

EXT.	DETER.	RESULTS OR STATUS			OUT OF RANGE?	GOOD ANS?	CHARGE CODE
****	********	**********			***	***	******
1210	TB MISC	2.03000E 02	pCi/G		N	Y	VOGEL
1211	AT MISC	6.29000E 00	pCi/G		N	Y	VOGEL
2182	GEA-V&A	< 3.94000E 00	pCi/G	Cs-137	N	Y	VOGEL
2182	GEA-V&A	3.54000E 03	pCi/G	Eu-152	N	Y	VOGEL
2182	GEA-V&A	4.29000E 02	pCi/G	Eu-154	N	Y	VOGEL
2182	GEA-V&A	1.97000E 01	pCi/G	Eu-155	N	Y	VOGEL
2182	GEA-V&A	7.61000E 01	pCi/G	Co-60	N	Y	VOGEL
3883	Sr-V&A	1.33000E 00	pCi/G		N	Y	VOGEL

END OF REPORT

SAMPLE STATUS REPORT FOR E 829. E-BLANK A07C37 TIME: 8/18/93 11:14
DISPATCHED: 7/27/93 13:48 SAMPLE HAS NOT BEEN SLURPED
RECEIVED: 7/27/93 13:57

EXT.	DETER.	RESULTS OR STATUS		OUT OF RANGE?	GOOD ANS?	CHARGE CODE
2182	GEA-V&A	7.15000E 00 pCi/G	Cs-137	N	Y	VOGEL
2182	GEA-V&A	2.51000E 01 pCi/G	Co-60	N	Y	VOGEL
2182	GEA-V&A	4.66000E 02 pCi/G	Eu-152	N	Y	VOGEL
2182	GEA-V&A	5.52000E 01 pCi/G	Eu-154	N	Y	VOGEL

END OF REPORT

This page intentionally left blank.

APPENDIX D

DISPERSION MODEL

This page intentionally left blank.

EPIcode 4.1 S/N 12149 BATTELLE
SUBSTANCE I.D. : COBALT 60 Library-

ERPG-1 : 0.000 ppm ERPG-2 : 0.000 ppm ERPG-3 : 8141532876100000000000000000000

CONTINUOUS : 7.4E-13 gram/sec

HEIGHT-EFFECTIVE: 0 Meters
SURFACE WIND SPEED :6.3 Meters/second
DEPOSITION VELOCITY: 1.000 cm/second
STABILITY CLASS : D
TERRAIN : STANDARD
RECEPTOR HEIGHT (z) : 0 Meters

LOCATION OF MAXIMUM CONCENTRATION LEVEL
Distance : < 0.10km
Level : > < 0.0001 mg/m^3

DOWNWIND Distance-km	CONCENTRATION mg/m^3	ARRIVAL TIME hours:minutes
0.10	8.0E-13	0: 0
0.20	2.1E-13	0: 1
0.30	9.8E-14	0: 1
0.40	5.8E-14	0: 1
0.50	3.9E-14	0: 1
0.60	2.8E-14	0: 2
0.70	2.1E-14	0: 2
0.80	1.7E-14	0: 2
0.90	1.4E-14	0: 2
1.00	1.2E-14	0: 3
2.00	3.7E-15	0: 5
3.00	2.0E-15	0: 8
4.00	1.3E-15	0:11
5.00	9.3E-16	0:13
6.00	7.1E-16	0:16
7.00	5.7E-16	0:19
8.00	4.8E-16	0:21
9.00	4.1E-16	0:24
10.0	3.5E-16	0:26
20.0	1.4E-16	0:53
40.0	5.7E-17	1:46
60.0	3.4E-17	2:39
80.0	2.4E-17	3:32
100	1.8E-17	4:25

EPIcode 4.1 S/N 12149 BATTELLE
SUBSTANCE I.D. : LEAD CHROMATE Library-91
Molecular Weight : 323.2 gram/mole
CAS Number: [7758-97-6]
TWA : 0.050 mg/m^3

CONTINUOUS : 7.4E-13 gram/sec

HEIGHT-EFFECTIVE: 0 Meters
SURFACE WIND SPEED :6.3 Meters/second
DEPOSITION VELOCITY: 1.000 cm/second
STABILITY CLASS : D
TERRAIN : STANDARD
RECEPTOR HEIGHT (z) : 0 Meters

LOCATION OF MAXIMUM CONCENTRATION LEVEL
Distance : < 0.10km
Level : > < 0.0001 mg/m^3

DOWNWIND Distance-km	CONCENTRATION mg/m^3	ARRIVAL TIME hours:minutes
0.10	8.0E-13	0: 0
0.20	2.1E-13	0: 1
0.30	9.8E-14	0: 1
0.40	5.8E-14	0: 1
0.50	3.9E-14	0: 1
0.60	2.8E-14	0: 2
0.70	2.1E-14	0: 2
0.80	1.7E-14	0: 2
0.90	1.4E-14	0: 2
1.00	1.2E-14	0: 3
2.00	3.7E-15	0: 5
3.00	2.0E-15	0: 8
4.00	1.3E-15	0:11
5.00	9.3E-16	0:13
6.00	7.1E-16	0:16
7.00	5.7E-16	0:19
8.00	4.8E-16	0:21
9.00	4.1E-16	0:24
10.0	3.5E-16	0:26
20.0	1.4E-16	0:53
40.0	5.7E-17	1:46
60.0	3.4E-17	2:39
80.0	2.4E-17	3:32
100	1.8E-17	4:25

DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	J.A. Locklair	Date 4/1/94
Project Title/Work Order		EDT No. 601420
Safety Assessment for the Decontamination and Dismantlement of the 107-C, 107-KE, 107-KW, and 107-F Retention Basins		ECN No.

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
K.A. Gano	X0-21	X			
L.C. Haslam	X0-51	X			
N.R. Kerr	H4-67	X			
J.A. Locklair (2)	H4-67	X			
H.E. Marquez	H4-67	X			
M.A. Mihalic	X5-55	X			
J.C. Plastino	X0-20	X			
K.A. Smith	N1-06	X			
M.A. Tredway	R3-54	X			
J.J. Zimmer	H4-67	X			
EPIC (2)(1)	H6-08	X			
ERPSE (3)	H4-67	X			
Central Files (original + 2)	L8-04	X			
Docket Files (2)	H5-36	X			

THIS PAGE INTENTIONALLY
LEFT BLANK